

Application Serial No. 10/603,306  
Reply to Office Action of September 13, 2004

PATENT  
Docket: CU-3271

### REMARKS/ARGUMENTS

Reconsideration is respectfully requested.

The Specification page 7, lines 15-24, has been amended to remove an inadvertent typographical error.

Claims 1-16 are pending in the present application before this amendment. By the present amendment, Claims 1-2, 5, 7-8, and 10-13 have been amended. No new matter has been added.

Claims 1-16 stand objected under 35 U.S.C. § 112, ¶2 as being indefinite.

As to Claims 1-2 and 12, all appropriate amendments have been made to render the claim definite.

In particular, as described in the Specification page 10, line 16 to page 11, line 10, the dielectric film 11 is a single composite film formed by annealing the layers of Ta<sub>2</sub>O<sub>5</sub> and Y<sub>2</sub>O<sub>3</sub> films deposited in an alternating manner. If the deposition amount for Ta<sub>2</sub>O<sub>5</sub> were, for example, 80%, the deposition of amount of Y<sub>2</sub>O<sub>3</sub> would be the remainder, i.e., 20% or "X(1-X)".

Claims 1 and 16 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,461,911 (Ahn). The "et al." suffix, which may appear after a reference name, is omitted in this paper.

In citing Ahn, the Office Action has made an assumption that the claimed single composite film contains Ta<sub>2</sub>O<sub>5</sub>, but not Y<sub>2</sub>O<sub>3</sub>. To further clarify the claimed invention, Claim 1 has been amended to recite --a single composite film having

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Ta<sub>2</sub>O<sub>5</sub> and Y<sub>2</sub>O<sub>3</sub> of ~~Ta<sub>2</sub>O<sub>5</sub>(X)Y<sub>2</sub>O<sub>3</sub>(1-X)~~. In view of this amendment, the rejection over Ahn has been overcome, and an indication thereof is respectfully requested.

Claims 1 and 16 stand rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 6,423,593 (Yamamoto) in view of U.S. Patent No. 6,423,593 (Chang).

It is respectfully pointed out (1) that neither Yamamoto nor Chang, considered individually or in combination, teaches every claimed limitation of Claim 1, and (2) the Office Action fails to state the prima facie burden of obviousness.

**NEITHER YAMAMOTO NOR CHANG TEACHES ALL CLAIMED ELEMENTS**

First, the claimed capacitor 20 (FIG. 1F) includes, at least: storage electrode 10 of polysilicon (Specification page 8, lines 17-23 and page 8, line 24 to page 9, line 6); a dielectric film 11 which is a composite film of Ta<sub>2</sub>O<sub>5</sub> and Y<sub>2</sub>O<sub>3</sub>; a diffusion barrier film 12 (see page 11, line 24 to page 12, line 6); and a plate electrode of polysilicon 13 (page 12, lines 6-10).

Chang is silent on any capacitor structure in a semiconductor memory.

Yamamoto, as shown in FIG. 17 and described in the corresponding text, teaches the capacitor structure that is completely different from the claimed invention. More specifically, Yamamoto teaches: a lower electrode 30 of Ru films (col. 9, lines 60-61); a capacitor insulating film 32 of a single layer tantalum oxide film; and an upper electrode 33 having Ru film (33a) and W film (33b).

There is no teaching of claimed polysilicon storage electrode and the plate

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electrode in Yamamoto. No claimed diffusion barrier film 12 is taught in Yamamoto. Further, Yamamoto teaches the single layer tantalum oxide film dielectric layer made by a conventional CVD process, which has numerous associated problems as described in the Specification page 2, line 23 to page 3, line 8, all of which have been overcome by the presently claimed invention.

Further, neither reference teaches the following limitation, now added to

Claim 1:

--forming layers of Ta<sub>2</sub>O<sub>5</sub> and Y<sub>2</sub>O<sub>3</sub> one layer over the other layer in an alternating fashion on the storage electrode according to ALD (Atomic Layer Deposition) technology--

Applicants request a specific showing of teaching of above claimed limitation in the cited references.

Thus, at least for the reasons above, Applicants respectfully submit that Claim 1 and all dependent claims are considered to be in condition for allowance. An indication thereof is respectfully requested.

#### **NO PRIMA FACIE SHOWING OF OBVIOUSNESS**

Yamamoto in its entire disclosure is directed to (1) the conventional technique of using a CVD process (2) to form a single layer structure of tantalum oxide dielectric layer structure (3) using materials other than polysilicon to form its lower and upper electrodes.

Various problems associated with forming a single layer tantalum oxide using polysilicon electrodes are stated in the Specification page 2, line 23 to page 3, line

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8:

Although  $\text{Ta}_2\text{O}_5$  film has a high dielectric constant, its formation is troublesome due to its material properties, and it reacts with polysilicon of a storage electrode to form an interface film when it is deposited according to a CVD method. In addition,  $\text{O}_2$  loss occurring in a  $\text{Ta}_2\text{O}_5$  film causes leakage current.

In conclusion, there is a difficulty in securing sufficient capacitance of a capacitor without loss of its performance through use of the conventional capacitor formation techniques and a single film of  $\text{Ta}_2\text{O}_5$ .

Because of these problems, Yamamoto teaches using a non-polysilicon material such as Ruthenium (Ru) and Tungsten (W) for its electrodes. That is, Yamamoto's invention is about improving the conventional CVD process for forming a conventional capacitor structure of a single layer tantalum oxide but utilizing non-polysilicon materials for electrode. Yamamoto therefore completely lacks any motivation or suggestion for using the claimed method that includes the ALD technology, for example, to form the composite film of  $\text{Ta}_2\text{O}_5$  and  $\text{Y}_2\text{O}_3$  and polysilicon electrodes. Yamamoto, in fact, teaches away from the teachings of the presently claimed invention, as this is evidenced in Yamamoto.

As to Chang, Applicants respectfully note that the presently claimed invention is not directed just to an ALD technology. The presently claimed invention is directed to forming a new capacitor structure, which takes advantage of the ALD technology, an embodiment of which is shown in FIG. 1F. Chang relates to the ALD technique applied in a conventional CVD system and/or equipment.

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Chang in [0012] describes generally about a layer having the tantalum oxide and yttrium oxide, but Chang lacks the teaching or suggestion of applying it in a memory capacitor structure to solve the problems of the conventional structure.

It is respectfully submitted that the basis for improperly finding the presently claimed invention obvious in view of Chang appears to be the teaching found in the present application, and not in the prior art. Thus, the obviousness rejection in the Office Action improperly relies on the impermissible hindsight reasoning, because the rejection would not be obvious absent the Applicants' disclosure in this application (see 37 C.F.R. § 1.104(c)(2)).

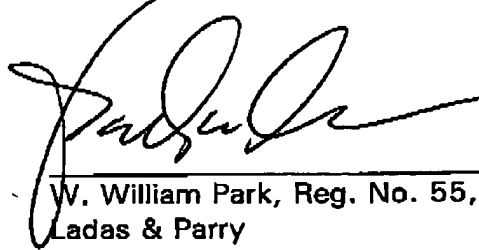
For the reasons set forth above, Applicants respectfully submit that Claims 1-16 pending in this application are in condition for allowance over the cited references. This amendment is considered to be responsive to all points raised in the Office Action. Accordingly, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections and earnestly solicit an indication of

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allowable subject matter. Should the Examiner have any remaining questions or concerns, the Examiner is encouraged to contact the undersigned attorney by telephone to expeditiously resolve such concerns.

Respectfully submitted,



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W. William Park, Reg. No. 55,523  
Ladas & Parry  
224 South Michigan Avenue  
Chicago, Illinois 60604  
(312) 427-1300